

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of)	
Use of Spectrum Bands Above 24 GHz For)	
Mobile Radio Services)	GN Docket No. 14-177
)	
Establishing a More Flexible Framework to)	IB Docket No. 15-256
Facilitate Satellite Operations in the 27.5-28.35)	
GHz and 37.5-40 GHz Bands)	
)	
Petition for Rulemaking of the Fixed Wireless)	
Communications Coalition to Create Service)	RM-11664
Rules for the 42-43.5 GHz Band)	
)	
Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95,)	WT Docket No. 10-112
and 101 To Establish Uniform License Renewal,)	
Discontinuance of Operation, and Geographic)	
Partitioning and Spectrum Disaggregation Rules)	
and Policies for Certain Wireless Radio Services)	
)	
Allocation and Designation of Spectrum for)	
Fixed-Satellite Services in the 37.5-38.5 GHz,)	
40.5-41.5 GHz and 48.2-50.2 GHz Frequency)	IB Docket No. 97-95
Bands; Allocation of Spectrum to Upgrade Fixed)	
and Mobile Allocations in the 40.5-42.5 GHz)	
Frequency Band; Allocation of Spectrum in the)	
46.9-47.0 GHz Frequency Band for Wireless)	
Services; and Allocation of Spectrum in the 37.0-)	
38.0 GHz and 40.0-40.5 GHz for Government)	
Operations)	
To: The Commission		

REPLY

The Boeing Company (“Boeing”) hereby replies to the oppositions that addressed Boeing’s petition for reconsideration (“Petition”). The Commission initiated this proceeding to ensure that the United States would be a leader in millimeter wave (“mmW”) technology and that mmW spectrum would be used to help bridge the digital divide and make very high speed broadband available to all Americans. The Commission should continue to advance these goals by building on its foundation of highly efficient spectrum sharing through a balanced approach involving both terrestrial and satellite services that will help to ensure that mmW spectrum is

used to benefit everyone. Boeing urges the Commission to continue its service to the public interest by advancing the spectrally efficient measures identified in Boeing’s petition.¹

I. SATELLITES WILL HAVE A CRITICAL ROLE IN USING MILLIMETER WAVE SPECTRUM TO PROVIDE BROADBAND TO ALL AMERICANS

Shortly after his appointment, Chairman Pai identified his primary goal, stating “[w]e must work to bring the benefits of the digital age to all Americans.”² This is consistent with the Commission’s statutory mandate to ensure that advanced telecommunications capability is “being deployed to all Americans in a reasonable and timely fashion” including “by removing barriers to infrastructure investment and by promoting competition in the telecommunications market.”³

No one technology or regulatory policy can reliably address the digital divide and ensure the widespread availability of advanced telecommunications capability. Instead, the solution will involve contributions from multiple sources and a significant factor will be the launch of very high data rate broadband satellite systems operating in mmW spectrum. It is for this reason that Boeing is proposing to launch and operate a global non-geostationary orbital satellite (“NGSO”) system to operate in the V-band.

Terrestrial wireless interests seek to denigrate the important role of satellites in bringing broadband to all Americans. For example, Straight Path ironically argues that the expansive

¹ Intel and 5G Americas incorrectly argue that Boeing’s petition must be dismissed because it “must rely ‘on facts or arguments which have not previously been presented to the Commission.’” Intel Corporation Opposition Comments to Petitions for Reconsideration, GN Dkt. No. 14-177, at 9 (Jan. 31, 2017) (“*Intel Opposition*”) (quoting § 1.429); see also 5G Americas Opposition to Petitions for Reconsideration, GN Dkt. No. 14-177, at 5 (Jan. 31, 2017) (“*5G Americas Opposition*”). In fact, Section 1.429 states petitions that rely on facts or arguments not previously presented to the Commission may be filed only under very limited circumstances.

² Remarks of Ajit Pai, FCC Chairman (Jan. 24, 2017) (available at <https://www.fcc.gov/document/chairman-pai-remarks-federal-communications-commission>).

³ 47 U.S.C. § 1302(b).

capabilities of broadband satellite networks are “purely based on hypothetical proposals that have shown no support of investment, development, and deployment efforts.”⁴ In the Ka-band, however, the satellite industry operates extensive systems that provide global services. In contrast, little use has been made of Local Multipoint Distribution Service (“LMDS”) licenses.

Other parties argue incorrectly that demand for satellite services is not growing.⁵ The satellite industry is enjoying very healthy growth. 5G Americas also argues that the satellite industry serves far fewer customers than terrestrial wireless networks.⁶ This misses the point. It is relatively easy to provide broadband to very large populations in cities. It is far more difficult to provide the same level of broadband service to families and businesses in rural areas. Just because the latter challenge may involve fewer people does not make it less important.

Finally, 5G Americas argues that broadband satellite systems do not provide services at the same speeds as terrestrial networks.⁷ Boeing and others are designing satellite systems using mmW spectrum that can support data rates greatly in excess of the Commission’s current broadband goals and that can provide a very attractive competitive alternative to terrestrial systems (where they exist). Importantly, however, these broadband satellite systems will be able to provide these very high speeds only if they are given access to sufficient mmW spectrum.

In challenging the need for spectrum sharing, a few terrestrial interests claim that they will use mmW spectrum outside of urban areas, despite the repeated acknowledgements of CTIA and others to the contrary. For example, Skyriver Communications provides as an example of

⁴ Opposition of Straight Path Communications Inc. to Petitions for Reconsideration, GN Dkt. No. 14-177, at 5 (Jan. 31, 2017) (“*Straight Path Opposition*”).

⁵ *5G Americas Opposition* at 4.

⁶ *See id.*

⁷ *See id.* at 5.

such rural service that “if the economics make sense, a BTA or EA licensee can meet an isolated request for service in a rural county or PEA, even if it is likely to be the only service request in that area.”⁸ Such one-off deployments will not help appreciably in resolving the digital divide.⁹

The Commission should therefore recognize that the clearest path to ensuring that mmW spectrum is used to serve all Americans is by continuing to promote the growth of multiple broadband distribution technologies, including satellite, and to encourage spectrum sharing wherever possible to bridge expeditiously the persistent digital divide. The modest regulatory measures requested by Boeing in its petition will advance these efforts.

II. THE COMMISSION SHOULD RECONSIDER ITS ADOPTION OF A TWENTY FOLD INCREASE IN THE UMFUS BASE STATION POWER LEVEL

The Commission should advance the goals of regulatory certainty and spectrum sharing by reconsidering its adoption of a base station power limit of 75 dBm. Although UMFUS proponents argue for unfettered flexibility, the need for regulatory certainty to promote greater use of mmW spectrum dictates a more thoughtful and balanced approach.

Notably, only CTIA, Nokia, and T-Mobile opposed Boeing’s call for reconsideration of the 75 dBm power level, each of them claiming that the higher power may be useful to enable wide area coverage modeled on traditional cellular networks.¹⁰ The extensive record in the

⁸ *Id.* at 9.

⁹ Other mmW spectrum holders make similar assertions. For example, some LMDS licensees advocate for a build out rule of “four permanent links per one million people substantial service benchmark” or, as an alternative, permit incumbent licensees to meet buildout requirements “for only one county within an existing licensed BTA (for LMDS), or one PEA within each EA (for 39 GHz).” Blooston, Mordkofsky, Dickens, Duffy & Prendergast, LLP Comments in Support of Petitions for Reconsideration, GN Dkt. No. 14-177, at 3 (Jan. 31, 2017).

¹⁰ See Opposition of CTIA, GN Dkt. No. 14-177, at 9-11 (Jan 31, 2017) (“*CTIA Opposition*”); Comments of Nokia, GN Dkt. No. 14-177 at 8 (Jan. 31, 2017) (“*Nokia Comment*”); Opposition of T-Mobile USA, Inc., GN Dkt. No. 14-177, at 9-10 (Jan. 31, 2017) (“*T-Mobile Opposition*”).

Spectrum Frontiers proceeding, however, documents very clearly that mmW spectrum will be used by terrestrial licensees to provide very small cell overlay coverage in dense population areas, not to replicate existing cellular networks that are already using lower spectrum bands. Therefore, the underlying justification for the substantial power increase lacks credible support.

In contrast, the undesirable impacts of substantially higher UMFUS base station power levels on broadband satellite services are very real. As SES and O3b explain, “O3b, the only operating millimeter wave band NGSO FSS broadband system, is a low elevation angle NGSO system with an interest in expanding into the 37/39 GHz band. As a result of its low elevation angle, the arbitrary increase in terrestrial power limits could substantially constrain O3b’s ability to site earth stations in the band.”¹¹ Therefore, it is appropriate for the Commission to reconsider its power limits for UMFUS base stations based on the actual UMFUS deployment scenarios that have been documented in this proceeding.

III. THE COMMISSION CANNOT REJECT OTHER MEASURES NEEDED TO PROMOTE SPECTRUM SHARING AND REGULATORY CERTAINTY SIMPLY BY CONCLUDING THAT THEY ARE LIKELY TO HAPPEN

Boeing identified several non-burdensome measures, such as beamforming and power control, to promote spectrum sharing in the 37/39 GHz band and permit satellite end user terminals to operate on an opportunistic basis. With respect to most of these measures, terrestrial interests acknowledged that, not only would they not be burdensome, but they will likely be employed in UMFUS networks to prevent intra-system interference.¹² The terrestrial interests

¹¹ Opposition to Petitions for Reconsideration of SES Americom, Inc. and O3b Limited, GN Dkt. No. 14-177, at 14-15 (Jan. 31, 2017).

¹² *T-Mobile Opposition* at 12 (explaining that “manufacturers have contemplated beamforming (off-axis) requirements that are more stringent than what Boeing has proposed”); Opposition and Comments of Skyriver Communications, Inc., GN Dkt. No. 14-177, at 7 (Jan. 31, 2017) (“*Skyriver Comments*”) (asserting that beamforming and power control “will almost certainly be

thus continue to question why such regulations are necessary, never once acknowledging Boeing’s clearly stated reason. As Chairman Pai explained, it is a Commission priority “[t]o give entrepreneurs, investors, and innovators the *regulatory certainty* they need to invest in next-generation infrastructure.”¹³ Boeing requires regulatory certainty to invest the billions of dollars necessary to construct and operate its global satellite system.

Some terrestrial interests argue the Commission should not dictate the design of UMFUS systems because this could freeze innovation.¹⁴ Boeing, of course, is not asking the Commission to dictate the manner in which beamforming and power control are implemented in UMFUS systems, solely that such capabilities be required.¹⁵ Terrestrial interests further argue that no Commission precedent exists for requiring beamforming and power control.¹⁶ In fact, the

an element of all” mmW deployments); *Nokia Comments* at 9 (arguing such measures “are inherent characteristics of anticipated 5G technologies”); *5G Americas Opposition* at 14-15 (explaining these will be needed “to limit self-interference and provide coverage”); *Intel Opposition* at 10 (noting these technologies will be used).

¹³ Statement of Commissioner Ajit Pai, Federal Communications Commission, Hearing on the FCC’s Fiscal 2015 Budget Request, before the Subcommittee on Financial Services and General Government Committee on Appropriations, U.S. Senate (March 27, 2014) (*emphasis added*).

¹⁴ *Skyriver Comments* at 7 (noting manufacturers “are likely to implement those techniques in different ways”); *5G Americas Opposition* at 14 (arguing the FCC should not “define the design of UMFUS equipment including mandates dictating equipment deployment configurations”).

¹⁵ In opposing this approach, T-Mobile and Intel both selectively quote the same Commission statement that “given the wide variety of deployments and uses we expect to see in these bands, it would be inappropriate to universally mandate these design features in every deployment, . . .” *T-Mobile Opposition* at 13, *Intel Opposition* at 10 (both quoting *Order*, ¶ 67). T-Mobile and Intel both omit the rest of the Commission’s statement, which was “. . . in the absence of more credible support for the proposition that satellite systems will receive harmful interference from mmW mobile systems.” *Order*, ¶ 67. The Commission was obviously referencing its conclusion that insufficient evidence existed regarding the potential for aggregate interference into satellite spacecraft receivers in the 28 GHz band. In contrast, and as explained in Boeing’s petition, the Commission has recognized that a significant opportunity exists for additional spectrum sharing in the 37/39 GHz band through opportunistic measures involving satellite end user terminals.

¹⁶ *T-Mobile Opposition* at 13; *CTIA Opposition* at 11.

Commission has frequently adopted off-axis beamforming and power control rules for wireless services, including in the 28 and 39 GHz bands.¹⁷ Further, contrary to Intel’s assertion,¹⁸ the Commission was obligated to address in its *Order* its reason for rejecting Boeing’s proposed sharing measures in the 37/39 GHz band given their importance to efficient spectrum use.¹⁹

The Commission should also advance the goals of regulatory certainty and spectrum sharing by precluding the use of omni-directional antennas. FWCC acknowledges that a ban on omnidirectional antennas would be appropriate for traditional Part 101 fixed point-to-point systems.²⁰ FWCC incorrectly asserts, however, that such a prohibition “would effectively prevent the deployment of UMFUS base stations that must communicate continuously with multiple units in motion.”²¹ On the contrary, UMFUS base stations will be able to communicate with multiple mobile units using multi-panel phased array antennas and tight beam forming, not by broadcasting signals indiscriminately using omni-directional antennas.

The Commission should also consider the adoption of a total radiated power (“TRP”) emissions limit for UMFUS systems. Several parties suggested in their comments that the EIRP density rules provide equivalent or sufficient protection for managing interference.²² An EIRP

¹⁷ See Petition for Reconsideration of The Boeing Company, GN Dkt. No. 14-177, at 12-16 (Dec. 14, 2016) (“*Boeing Petition*”).

¹⁸ *Intel Opposition* at 10.

¹⁹ Intel and 5G Americas also argue that beamforming and power control will be unnecessary due to the coordination rules to protect individually licensed earth stations. *Intel Opposition* at 10; *5G Americas Opposition* at 9. Beamforming and power control are needed, however, to facilitate sharing with unlicensed satellite end user terminals, not licensed earth stations.

²⁰ Comments of the Fixed Wireless Communications Coalition, GN Dkt. No. 14-177, at 11 (Jan. 31, 2017) (“*FWCC Comments*”).

²¹ *Id.*

²² See, e.g., *T-Mobile Opposition* at 11-12; *CTIA Opposition* at 10-11.

density limit, however, does not preclude radiating the stated EIRP in all directions simultaneously, whether by means of a high power omni-directional antenna, or using multiple narrow beams with non-overlapping field of views. In contrast, a TRP rule would provide insight into the maximum number of beams that can be expected to be radiated from a UMFUS base station within a given coverage volume. Boeing therefore urges the Commission to continue to consider a TRP limitation, or impose a minimum antenna gain requirement on UMFUS base stations, which would both preclude omni-directional radiation and provide the necessary insight into the simultaneous transmission density from UMFUS base stations.

Finally, the Commission should eliminate confusion by restoring its rules for fixed services in Part 101, rather than comingle them with the rules for mobile services in Part 30, and clarify that they are not applicable to UMFUS devices including base stations. In large part, this would eliminate the potential for confusion regarding both the application of the higher EIRP limitation of 85 dBm and the potential for use of omni-directional antennas for UMFUS services.

IV. THE ORDER ARBITRARILY AND UNNECESSARILY DISCOURAGES THE PLACEMENT OF SATELLITE EARTH STATIONS IN RURAL AREAS

The U.S. commercial satellite industry has almost uniformly urged the Commission to reconsider its earth station siting restrictions, arguing that the numerical limit of three per county or partial economic area (“PEA”) will be insufficient to accommodate the large number of earth stations that need to be deployed and the percentage limit of 0.1% discourages satellite operators from locating earth stations in rural and semi-rural locations. The only satellite operator that argued in favor of the current limits was ViaSat, which apparently plans to locate its earth stations in urban centers (where the 0.1% limit is effectively far less restrictive). Most other satellite operators want to place earth stations in rural areas, but the 0.1% limit may preclude this.

In contrast, some terrestrial interests seem open to a compromise. The FWCC agrees that the numerical limit is unnecessary, explaining, “[w]e do not oppose dropping the three-per-license-area limit while keeping the 0.1 percent population limit.”²³ The FWCC also supports creating a tiered approach for the 0.1 percent limit based on population.²⁴ Boeing could agree to a slight modification to the FWCC proposal as applied to PEAs in the following manner:

Tier 1 - High population PEA	Population greater than 1,500,000	FSS earth stations may cover no more than 0.2% of the license area’s population
Tier 2 – Low to medium population PEA	Population between 60,000 and 1,500,000	FSS earth stations may cover a total of 3000 people in each PEA
Tier 3 – Very low population PEA	Population less than 60,000	FSS earth stations may cover 5% of the license area’s population

V. NO PARTY CHALLENGES THE PUBLIC INTEREST BENEFITS OF PERMITTING SATELLITE END USER TERMINALS TO OPERATE IN THE 42.0-42.5 GHZ BAND ON A SHARED OPPORTUNISTIC BASIS

The Commission first acknowledged in 2010 that it would be appropriate to authorize FSS in the 42.0-42.5 (“42”) GHz band.²⁵ The Commission sought further comment on this and other potential uses for the 42 GHz band in the Spectrum Frontiers NPRM.²⁶ In a stark reversal, the *Order* declined to create an FSS allocation in the 42 GHz band, incorrectly concluding that broadband satellite services will not need this downlink capacity.²⁷ Boeing’s petition highlights

²³ *FWCC Comments* at 4.

²⁴ *See id.*

²⁵ *See* Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands, *Third Further Notice of Proposed Rulemaking*, 25 FCC Rcd 15663 (2010).

²⁶ In the Matter of Use of Spectrum Bands Above 24 GHz for Mobile Radio Services, *Notice of Proposed Rulemaking*, 30 FCC Rcd 11878 (2015) (“*NPRM*”).

²⁷ *Order*, ¶ 368.

the critical need of the satellite industry for additional downlink capability.²⁸ T-Mobile, however, disregards Boeing's showing and claims that Boeing's request for reconsideration is premature because the Commission is considering a possible UMFUS allocation in the 42 GHz in the *Further Notice*.²⁹ Boeing, however, has shown that the 42 GHz band can be shared by both UMFUS and satellite downlink services. Boeing was therefore procedurally required to seek reconsideration of the *Order* despite T-Mobile's suggestion to the contrary.

Other satellite service providers have also highlighted the importance of allowing broadband satellite systems to share the 42 GHz band. As Echostar explained, "the decision not to allocate the 42.0-42.5 GHz band for use by FSS systems will needlessly preclude sharing in that band and thus limit the capabilities of those systems and the range of services they can offer to customers in the United States."³⁰ The Commission should therefore advance the public interest by authorizing both UMFUS and broadband satellite services in the 42 GHz band.

Respectfully submitted,

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²⁸ *Boeing Petition* at 21-22.

²⁹ *T-Mobile Opposition* at 20.

³⁰ Comments of Echostar Satellite Operating Corporation and Hughes Network Systems, LLC on Petitions for Reconsideration, GN Dkt. No. 14-177, at 3 (Jan. 31, 2017).

CERTIFICATE OF SERVICE

I, Bruce A. Olcott, hereby certify that on February 24, 2017, I caused a copy of the foregoing Reply of The Boeing Company to be served by U.S. first-class mail, postage paid, upon each of the following:

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